☛ SCHOLARSHIP & CERTIFICATE CANDIDATES, *see pp. 10—13.*

THE PRACTICAL TEACHER

A WEEKLY JOURNAL FOR MASTERS MISTRESSES AND STUDENTS

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New Inspection Questions.

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Standard I.

Arithmetic.—Dictate the following sums:—

1. Add 534, 25, 143, 78 and 125. Ans. 905.
2. From 913 take 139. Ans. 774.
3. From 500 take 199. Ans. 301.

Writing.—Write from copy on black-board.

Silk is brought from many parts of the globe.

Mental Arithmetic.—

1. 14 boys and 11 boys. Ans. 25.
2. How many fives in 25? Ans. 5.
3. Twenty-five pence, how much money? Ans. 2s. 1d.
4. Take thirteen pence away, how much left? Ans. 1s.
5. 17 marbles and 7 marbles Ans. 24.
6. How many more to make 40 marbles? Ans. 16.
7. Divide 40 marbles among 5 boys. Ans. 8 each.
8. Ten marbles a penny, how many for 6d.? Ans. 60.
9. Four pounds of sugar at 2½ per lb. Ans. 10d.
10. How much change out of a florin? Ans. 1s. 2d.
11. Take eight-pence away, how much is left? Ans. 6d.
12. Divide remainder among 4 boys? Ans. 1½d. each.

Geography.—

1. What map have you seen?
2. Which is north on a map?
3. Point to the North of your room.
4. What point is opposite the North?
5. Where do we see the sun rise?
6. Does the sun *really* rise?
7. What is it then that moves?
8. When do we see the sun rise?
9. What time of the day is noon?
10. How can we tell when it is noon?
11. When is the sun highest in the heavens?
12. How are towns marked on a map?
13. What is a map?
14. Are countries drawn their real size on a map? Why not?
15. How are they drawn?
16. If the shape of your room is shewn on the black-board, what have we drawn?
17. Mention six things of which plans can be drawn.
18. What is the use of a plan?

Grammar.—

1. How can you tell a noun?
2. Who can tell me a noun?
3. What are the nouns in 'John went for a walk'?
4. Tell any difference you see in writing 'John' and 'walk.'
5. Mention three nouns for names.
6. Mention three nouns for things.
7. Point out the nouns in 'Fish swim in the sea.'
8. Is a fish a noun?
9. What is the noun then?
10. What nouns have capital letters?
11. Point out the nouns in 'Jack and Jill went up the hill.'
12. Is there any noun in this, 'I shall soon be well.'

Standard II.

Arithmetic.—Dictate the following sums:—

1. Multiply 6,459 by 36. Ans. 232,524.
2. Multiply 7,468 by 94. Ans. 701,992.
3. Divide 84,728 by 8. Ans. 10,591.
4. Take 9,017 from 16,016. Ans. 6,999.

Mental Arithmetic.—

1. What are seven times nine? Ans. 63.
2. How many more to make 100? Ans. 37.
3. How did you find this out?
4. By what rule did you do it? Ans. Subtraction.
5. Divide 100 marbles among 10 boys. Ans. 10 each.
6. How many half-crowns in 5 shillings? Ans. 2.
7. Divide 60 apples among 4 boys. Ans. 15 each.
8. Fifteen buns at 1d. each. Ans. 1s. 3d.
9. How much change from half-a-crown? Ans. 1s. 3d.
10. How many children could have threepence out of half-a-crown? Ans. 10 children.
11. How many ½d. buns could I get for 1s. 0½d? Ans. 25 buns.
12. How many dozen in 25? Ans. 2 dozen.
13. How many over? Ans. 1 over.

Dictation.—Write from dictation:—

All this time she was not idle. She had taken the handkerchiefs and cuffs and collars, but she had found them a little too dry, so she sprinkled them first as she had seen her mother do, folded them up, and afterwards taking them one by one, she nicely ironed them out.

Geography.—

1. What piece of water washes the South of England?
2. What is a Channel?
3. Where is the North Sea?
4. How are the English Channel and North Sea joined?
5. What is a strait?
6. What water runs into the sea?
7. What is that part of a river called where it joins the sea?
8. What kind of water is it in the sea?
9. What kind in a river?
10. Where is the narrowest part of a river found?
11. What is this called?
12. Mention a river that runs into the sea?
13. What is the use of rivers?
14. What kind of land is it where rivers rise?
15. What pieces of water are found in valleys?
16. What is a valley?
17. If land has water all round it, what is it called?
18. If you have been at the sea-side, is the beach always covered with water?
19. How is this?
20. What is the rising and falling of the water of the sea called?

Grammar.—

1. What is a noun?
2. How many kinds of nouns are there?
3. Name a proper noun.
4. Name a common noun.
5. Why is the one called *proper*?
6. Why is the other called *common*?
7. What difference would you make in writing them?
8. Which would have a capital letter?
9. Point out the noun and the verb in 'I went for a walk?'
10. Is the word '*walk*' always a noun?
11. What else may it be?
12. Give an example of *walk* as a verb.

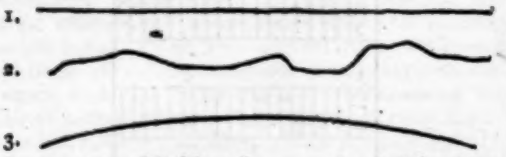
☞ **COMPLETE SETS of Test Cards, for EACH Standard, printed in bold type, will appear in an early Number of the 'Practical Teacher.'**

Teachers' Notes of Drawing Lessons for Standard I.*

By an Art Teacher under the London School Board.

I.

Materials.—Slates without lines, half-sticks of pencil previously sharpened. Blackboard about the same shape as the slates.

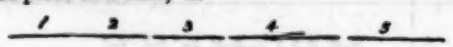


Draw across blackboard:— 1. A straight line. 2. A crooked line. 3. A bent line.

Ask for examples of each. Show especially the straight edges of new books, as contrasted with the ragged crookedness of old ones. When the class is familiar with the three varieties of line, proceed to show

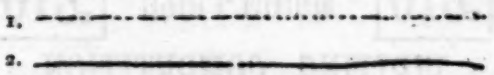
How to draw a straight line:

'A piece at a time,' as



counting as the line is drawn—'No 4 is going crooked—rub it out' and go on again till a fairly good line reaches all across the board.

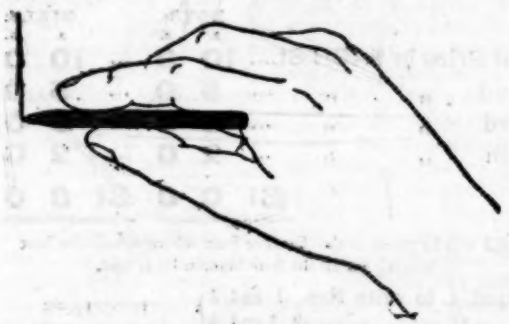
Not in little bits or dots, as 1. *Not* in very large pieces as 2.



Before the children try they must be shown

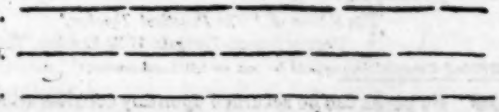
How to hold the pencil:

With the hand resting on its side, the pencil more horizontal than in writing, and held a little farther from the point.



When the children have drawn their lines, copying from the board, find out

The best sort of straight line, looking among the slates for examples: 1. Thick. 2. Middling. 3. Thin.



Show the examples, and imitate them on the blackboard, praising all for their straightness, but No. 3 as the best. Lines must be as thin as possible at first, in order to get the children into the habit of drawing lightly. 'Try again.' Look out for children who use the pencil as a prop to rest their hands on while they work.

Exercise.—1. Draw a *thin* line all across the slate near the top.

2. Draw another across the middle—*thinner.*

3. Draw a third line across near the bottom—*thinner still.*

II.

Obtain from class the points of previous lesson:—

Lines to be straight—a piece at a time—thin—not bent—not crooked—&c.

Point to point.—

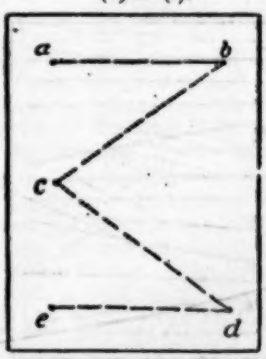
Place two dots on blackboard and draw line as shown (1). 'Is the line going to the dot?' Make it do so (2). 'Is it a straight line, a bent line, or a crooked line?' 'It won't do, it *must be straight.*' Rub out half of it and complete again (3). Still not right. Rub out all of it and try again.

The children must see that they cannot possibly bend a straight line, as of course it would then be no longer straight; and that if a line is not going straight to the right place it cannot be made to do so in this way. Great attention should be paid to this point.

Place dots in other positions and draw straight lines (4), (5). These lines are *straight* but not *level.* Explain 'straight'—'level.'

Exercise.—

Draw from (*a*) to (*b*),
(*b*) to (*c*),
(*c*) to (*d*),
(*d*) to (*e*).



* The Teaching of Drawing becomes compulsory on September 1st, 1891. These articles will be specially helpful to teachers who know but little of the subject. They will teach them how to teach it successfully.

Turn blackboard and slates sideways

'What is it?'

Mark the slates with coloured chalk:—

F. (blue) all that show anything at all like carefully drawn lines.

G. (blue) careful lines and a fair copy of the figure.

G. (red) a few of the best.

Let the slates be held up to be counted; 'F's' first, then blue 'G's,' then red 'G's,' but take no particular notice of those without any mark.

The 'Red G' will quickly become a much desired distinction.

III.

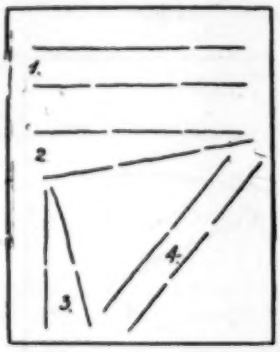
'Last lesson?' 'Can't bend straight lines.'

Parallel lines.—

Draw on blackboard two straight lines (1). 'These lines are like?' 'Ruler'—'Top of desk'—'Tram-lines,' &c.

Draw (2): 'What is the difference between (1) and (2)?' 'Nearer together at one end than the other.' 'They would meet if they were longer.'

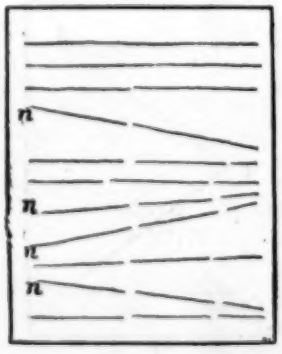
In (1) the lines would never meet, however much longer they were made, never get nearer together, never get farther apart. They are called *parallel* lines. (2) are not parallel. 'Are these?' (3), (4).



Draw a number of lines and let the children say which are parallel (to other lines) and which are not.

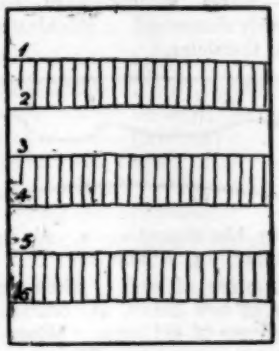
Rub out the latter (*n*). 'How many parallel lines left?' 'What are they parallel to?'

To each other—top and bottom of board—floor and ceiling.



Exercise.—Draw parallel lines, count them and put numbers by them.

Fill up between 1 and 2, 3 and 4, 5 and 6, with a few upright lines. These lines always please the children, but some discretion should be used in allowing them. They should be few in number, parallel, and not allowed to become a mere scrubby patch.



(To be continued.)

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Needlework for Pupil-Teachers.

BY MISS SOPHY LOCH,

Examiner in Needlework to the London School Board.

THE term 'Needlework' is a very wide one, including, as it does, besides the mere knowledge of hemming, seaming, cutting-out a dress or petticoat, darning a stocking or patching under-linen, the art of embroidery, tapestry work, and those beautiful and varied stitches with which many articles of clothing are adorned. From very ancient days needlework has been one of the most constant occupations of women, and also appears to have been, among the earliest nations known to us, one of the most highly regarded. All are familiar with Solomon's description of the virtuous woman—'She maketh for herself coverlets, her clothing is fine linen and purple.' 'She maketh fine under-garments and selleth them.' Then, again, the old story of Arachne's challenge to Minerva, and her defeat, show the important part that needlework played in even earlier times.

'Needlework preceded written history in recording heroic deeds and national triumphs,' and, in comparatively modern times, the women of the household spent a large portion of their day in working; not only spinning and weaving the cloths, out of which the garments for the household were made, but spending much care and labour in reproducing and picturing most faithfully current events which were stirring the world around them, as, for example, the Bayeux tapestry, representing the Battle of Hastings, while the celebrated cartoons of Michael Angelo were primarily designed to serve as patterns for ladies' work.

Apart from the artistic merits and the useful purposes of this branch of handiwork, the power of needlework to soothe a troubled mind and wearied brain was brought forcibly home to the minds of those who visited the Stuart collection in London some two years back, and who then saw the wonderful piece of work done by Mary Queen of Scots during her captivity in England. But she appears to have been fond of using her needle even before she had recourse to it as a means of passing her time. Again, while in captivity in 1590, when under the charge of the Earl and Countess of Shrewsbury, Nicholas White, afterwards Master of the Rolls in Ireland, thus described her answer to his enquiries—'I asked her Grace, since the weather did cut off all exercises abroad, how she passed the time within. She said that all the day she wrought with her needle, and that the diversity of the labours made the work seem less tedious, and continued at it till very pain did make her to give it over.' But handiwork is not confined to Queens of three hundred years ago; the present Queen and her daughters being all proficient, not only in art, but in plain needlework; her Majesty also having exhibited at Glasgow, some few years back, three table napkins woven from yarn, and spun by herself.

Several centres for teaching art needlework in its various branches have been started within comparatively few years back from the present date, and have done much to spread a love of beautiful designs and artistic colouring, but it is not within the power of all to devote themselves to this branch of needlework. It *is* however within the power of the many to practise themselves and instruct others in that branch of needlework termed 'plain needlework,' and it is to those who have to work themselves and teach others that some ensuing little articles on the subject will be addressed. The days are gone by when the use of the needle was supposed to be born in women, and it is now acknowledged that to obtain proficiency in needlework, careful and systematic education must be brought to bear upon it, as on any other branch of learning. It is far, of course, from being the most important subject to be learnt by girls and children, but it is thought none will deny its usefulness in the world, even in these days of sewing machines and cheap ready-made linen.

Though the subject of needlework has been much and often treated of in various books and papers, yet perhaps a few hints on the subject may not come amiss from one who has had a very varied experience in the subject, both as teacher and inspectress. The writer, therefore, proposes, in a few simple articles, to treat especially of pupil-teachers' work, taking first that required by the Code to be shown to Her Majesty's Inspector on the day of inspection, and then passing on to speak of some of the possible exercises given to the girls to work on the day itself. The first papers will therefore speak of the work required from the First Year Pupil-teachers.

In connection with these Articles it is intended to hold a series of Female Pupil-Teachers' Prize Competitions.—[Ed. P. T.]

Our Science Corner.

BY R. A. GREGORY, F.R.A.S.,

Honours Medallist in Physiography; Author of Elementary Physical and Astronomical Geography.

AT the Royal Society Soirée last June, and in five lectures 'On some points in the Early History of Astronomy,' recently delivered at Jermyn Street Museum, Professor J. Norman Lockyer gave a few results of an investigation into the orientation of Egyptian temples and other ancient monuments. An examination of the plans of Egyptian temples made by the French in 1798 and by the Prussians in 1844, indicates that the directions in which these temples were built were determined by astronomical considerations and not, as archæologists have supposed, by the direction of the river Nile. That the sun, moon, and the brightest planets and stars played a great part in the religious worship of the ancients is more than probable. It therefore seems plausible to suppose that the direction in which ancient places of worship were constructed should bear some relation to the position of these heavenly bodies. As an example of such a relationship the case of Karnok temples may be cited. There all the large temples point to those parts of the horizon at which the sun rises at the summer and winter solstices. Other

temples have been found with a true east and west direction, and therefore these point to the position of the sun at sunrise or sunset at the equinoxes. The religious ordinances of the Egyptians indicate that a great light was allowed to shine down the temples through an opening at one end, and be seen at certain periods. Independently of the religious uses of the temples, however, the length of the year could have been very accurately determined by observations made in them at the summer solstice. The brightest stars have most probably been used for similar purposes. If, therefore, the worship in a temple should indicate that it was connected with the rising of a certain star, say Sirius, the date in which the temple was erected might be approximately determined by calculating when precessional motion would have caused the star to rise on that point of the horizon towards which the axis of the building is directed; or conversely, if the date be known on which a temple was built to point to a certain star, the distance of the star from this azimuth at the present time would allow of a very accurate determination of any proper motion or of the value of precessional movement.

Professor Lockyer is now in Egypt for the purpose of gathering information to elucidate these points.

***

THE latitude of a place is generally supposed to be an invariable quantity, but a series of simultaneous observations made at Berlin, Potsdam and Prague in 1889 and 1890, indicate that it is subject to a periodical variation of a half a second of arc.

The maximum difference from the mean, of all the observations of latitude made throughout the year, occurs in July; the minimum difference occurs in January. The fact that the latitude of a place has a yearly period of variation, is not, however, new, but has been known to exist in the Greenwich observations for some years. The cause of the variation has yet to be found. The phenomenon implies an alteration in the direction of the earth's axis. Such an alteration would affect the position of the celestial poles and equator, and therefore the positions of stars relative to them. That the variations are connected with the seasons seem manifest from the observations. It may be that the varying amount of heat received throughout the year has affected the instruments and that the variation is not real. On the other hand, the same cause may affect the distribution of water on the earth's surface and bring about the transportation of a mass of water sufficient to give the axis a periodical and appreciable deviation. The amount of refraction by the atmosphere must also vary with the season, and this may cause the observed difference in the positions of the stars.

Monsieur Lamey showed, at the Paris Academy on November 17th, 1890, that the atmospheric tides produced by the sun and moon follow the same curve of variation as the observations of latitude. The physical consequence is that refraction phenomena must also vary with the tidal effect, and therefore the positions of stars may experience an annual periodical fluctuation comparable with that observed.

Whether the variation is due to a movement of the earth's axis or to changes in the condition of the atmosphere has yet to be determined.

***

AT the Paris Academy, on December 15th, 1890, Dr. Viault presented a note on the considerable increase in the number of blood corpuscles of inhabitants of elevated regions in South America. The observations show that the acclimation of man to high altitudes is not due to an increase of frequency of respiratory action, to a greater activity of pulmonary circulation, but to an increase in the number of red corpuscles in the blood. Thus, on October 4th, before starting for South America, Dr. Viault's blood contained 5,000,000 red corpuscles per cubic millimetre (= ·00006103 cubic inch). After staying fifteen days in Peru at an elevation of 14,771 feet above sea-level, the same volume contained 7,000,000 red corpuscles. Thus one of the first effects of rarefied air on living beings is a remarkable augmentation of the function. In a future communication Dr. Viault will establish the consequences which follow from this fact and some other results not yet published, both from the physiological point of view, and with reference to the curative action of the climates of elevated regions on pulmonary consumption, which, as is well known, is not found on the Andes.

***

THE moon rotates on her axis in the same time that she takes to revolve round the earth; the result is that she always presents the same side towards the earth. One of the most important astronomical results arrived at last year was that the planets Mercury and Venus rotate on their axes in the same time that they revolve round the sun, that is, in 88 days and 225 days respectively, hence they always present the same face to the sun. The time of axial rotation of these planets had previously been determined as 24 hours.

***

STUDENTS who intend sitting for the Physiography Examination next May should notice the following addition to the Syllabus given in the Science and Art Directory, 1890. 'In the examinations in the elementary and advanced stages, questions will be given in two groups; one of them containing questions which relate principally to Physical Geography, and the other will contain questions in the other part of the Syllabus; students will be required to answer questions in both groups.'

***

PROFESSOR SYLVESTER has recently published some researches in which he shows that π (the relation of the circumference of a circle to its diameter) cannot be the root of a rational equation, and that the squaring of a circle is therefore impossible. The demonstration will have little effect, however, upon those who attempt to accomplish this feat of mathematical gymnastics.

☞ Mr. Gregory's Physical and Astronomical Geography is Now Ready, superbly illustrated, Price 3s. 6d. Specimen sent for 2s. 6d., P.O.O. (Hughes & Co., London).

Publications Reviewed.

The Elements of English. By George Beach, M.A., LL.D. London: Joseph Hughes & Co.

This book has been written with a purpose, viz., that of providing a text book from which may be answered the peculiar questions set by examining bodies, complicated as they often are in the case of teachers by questions of Pedagogism. We have examined it carefully, and can vouch for the accuracy of the statement in the preface that it leaves no part neglected respecting which the Education Department has propounded any query during the past twenty years. Students therefore of whatever grade, whether pupil teacher, Scholarship or Certificate candidate, may buy the book, feeling perfectly sure that in it their wants will be met. Questions of difficulty are discussed as they arise, and conclusions drawn which, although they may not convince everybody, show that the author knows what he is talking about.

The arrangement of the book, the type, and the binding, are among the best of their class. A very good feature is that which gives the derivation of the technical terms in connection with the chapters where they are first used. Another good feature is that which places the questions on the chapters immediately after the chapters. Among these are many *answered* questions—models of what answers should be. We are of opinion, however, that subdivision seems in many cases to have been carried to excess. As instances of this, we may mention the classification of nouns and pronouns, the use of the dative case, and indirectly the absolute case and vocative case. We might as well adopt the number of cases used in the ancient languages. There is just as much to be said for the use of the genitive, vocative, and ablative, as for the dative. In a few cases we have noticed signs of haste in the preparation of the book, *e.g.*, in one case Dr. Beach speaks of *have* as the auxiliary of the *perfect* tense. In the classification of tenses, the author has no *perfect* tense at all. Again we are told that it is better not to use the term *indirect object*, and yet on p. 101 we have, 'The Dative case is used is an indirect object.' Some of the questions in groups refer to parts of the book which have preceded them, others to parts which follow. On page 161 we find the sentence 'Send three fly's to fetch us' as an instance of the use of the comma. We should have written *flys*. These, however, are slight blemishes when we consider the size and quality of the book. The chapter on paraphrasing is a welcome addition to the volume, while the history of the language is treated concisely and carefully. Forty pages of Government Examination questions with model answers make a good finish to the book.

The whole work is evidently written by one who knows what he wants to say, and says it in a crisp, clear and correct fashion. It will be a welcome addition to the libraries of those who are fond of books on English, and it will be found in every way suitable and sufficient for pupil teachers, college students, and candidates for Certificates, who often have to confine themselves to one book.

Dictionary of Idiomatic English Phrases. By I. M. Dixon, M.A., F.R.S.E. London: T. Nelson and Sons.

What strikes one when taking up this new volume is its excellent 'get up.' It is a positive pleasure to turn ove its pages. The paper, printing, and binding are alike excellent. And the book itself is worthy of Messrs Nelsons' best efforts.

Foreigners *must* have some such book as this if they wish to understand the Englishman's lingo as spoken at home. Mr. Dixon has, wisely, we think, backed up his use of 'Idiomatic English' by extracts from our most popular living writers.

It is just what nearly every dictionary is not—pre-eminently readable, racy, and instructive. We wish it a wide sale at home as well as abroad.

Blackie's Modern Cyclopædia. Edited by Dr. C. Annandale. London: Blackie and Son.

Of the earlier volumes of this important undertaking we were happily able to speak in terms of the highest praise. Now that the last volume of the work has been published we direct our readers special attention to Dr. Annandale's labours. He has given us a Cyclopædia at once clear, concise, accurate, and appropriately illustrated. And the publishers have sent it forth clad in a beautiful serviceable dress, and at a most moderate price.

In all our experience we have never come across an encyclopædia so handy, cheap, and valuable. It is a library in itself, and should find a place in every school in the kingdom. If any of our readers are in doubt what to buy a pupil-teacher at (say) the close of his (or her) apprenticeship, doubt no longer. Take our advice and buy Blackie's Modern Cyclopædia. It is an ideal present for student or teacher.

The Educational Annual. London: G. Philips and Son. Compiled by Edward Johnson.

Mr. Johnson not only deserves the thanks of his publishers, but of the entire educational public for the hard work he has just put into this admirable year-book. It teems with valuable information not otherwise readily come-at-able. Indeed its eems to us all but indispensable to teachers, school-managers, educationists, politicians and last, but not least, that long-suffering and much maligned body of public servants yclept publishers. We congratulate all concerned in the production of this work which has our hearty commendation. It is far and away the best of the many educational annuals now before the public.

Cornhill, (January 1891). London: Smith, Elder, and Co.

Cornhill is always welcome with its clear readable type, good paper, varied and interesting contents. In this issue that popular surgeon Mr. A. Conan Doyle gives us the opening chapters of what promises to be a novel worth reading, 'The White Compass.' And in these degenerate days that is no light praise. 'A Military Resident' is an ideal paper for a monthly.

We can with confidence recommend Cornhill.

The Century Magazine (Jan. 1891). London: T. Fisher Unwin.

This excellent monthly still maintains its high reputation. In the current issue we have the first instalment of the long-looked for 'Memoirs of Talleyrand. 'An Irish Gentlewoman in the Famine Time,' appears opportunely, and in addition to being interesting has the merit of being true. 'At the Town Farm,' is a beautifully touching sketch. Altogether the magazine is full of good things and embellished with wood cuts in faultless style.

☞ NOTICE.

☞ **Our next issue will contain particulars of a Prize Action Song Competition; also An Object Lesson for Infants (full notes), by James Bailey, Head Master, Southlands Training College.**

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London: BLACKIE & SON, Limited, 49 & 50, Old Bailey.

☞ Hughes's Domestic Economy. Now Ready. Cr. 8vo., 440 pp. Price 4s. 6d. Specimen, post free, 3s.

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To Subscribers.—The weekly numbers of the *Practical Teacher* are published every Thursday, and the monthly parts at the end of the month. Monthly parts, price 6d. ; post free, 7½d. ; sent post free, three months for 1s. 11d. ; six months, 3s. 9d. ; a year, 7s. 6d.

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To Correspondents.—All literary communications should be addressed, THE EDITOR OF THE PRACTICAL TEACHER, Pilgrim Street, Ludgate Hill, London, E.C.

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AT last we have the pleasure to present our readers with the *Practical Teacher* in the form they have so frequently expressed their desire to see it, viz., as a penny weekly journal. We shall now be able to meet the wants of teachers and students in a manner that hitherto has been impracticable. Without multiplying words we may perhaps be permitted to say that neither effort nor expense shall be spared to make the Journal welcome in every school in the land. From our many correspondents abroad, as well as at home, we shall, of course, always be glad to hear. We trust the change initiated to-day will do us the double service of uniting closer together the ties of old friendships, and of bringing us into touch with new friends of every clime and tongue.

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WE wish it to be distinctly understood that the weekly issue will in no way interfere with the regular publication of the monthly parts at the end of each month.

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IT is not often that in these columns we advocate anyone's claims for honours in the National Union of Teachers. But in breaking our rule we feel we are abundantly justified.

Mr. Bowden is pre-eminently qualified for the Vice-Presidency. His seventeen years work as a member of the Executive is in itself eloquent and adequate testimony in his favour. His practical experience as teacher and administrator, his keen sympathy with, and unflagging zeal on behalf of, struggling teachers, and his dogged determination to do what he conceives to be right, all point him out as a fit successor to Mr. Collins. In Mr. Bowden teachers have a staunch friend of conspicuous ability, true as steel. We speak from a personal knowledge extending now to well nigh a quarter of a century.

Truly, in honouring Mr. Bowden the National Union of Teachers will honour itself.

A Course of Object-Lessons and Elementary Science.

(Adapted to the Syllabus of the New Code and of the London School Board.)

BY RICHARD BALCHIN.

Head Master under the School Board for London.

A HUNDRED little fellows have just come over from the infant school. In the 'big boys' now! There they are in their new room. Some sitting, some standing still, apparently struck speechless with wonderment; all with big round eyes open to their very fullest. Never before were seen such wonder-waking eyes! What's that mark on the ceiling? What are those things in the glass-case? What's in all those bottles? What is that picture about? Ah! little ones! 'Blessed are they which do hunger and thirst after righteousness; for they shall be filled.' And blessed are the fillers who righteously fill. And you, little ones, shall be filled; your wonder-hunger shall be satisfied. The food shall be such as suits small digestions, and prepared to be by you most easily assimilated. No hard dry lumps that you will disgorge at the annual disgorgement called an 'Inspection,' and then for ever after know nothing of save for the injury wrought by the villainous work. No! It shall be something that you can grow upon. What is it the learned say? Grow from objectivity to subjectivity? Dryasdust! Look straight into those wide-open eye-windows! Right through them into those minds! How do *they* grow? What are the channels through which the mental-milk flows? How does it enter there? How does it incorporate with what is already there, and so build up, enlarge, strengthen?

I have prepared a course of object lessons for all the Standards beginning at the first. It is my intention to give full notes and explanations. Also, I propose reproducing, word for word, one or two lessons which I have actually given, with the questions, answers, and remarks of the boys, at least, so far as I am able to remember. This course will cover the syllabus of the New code, and of the School Board for London. It will also serve as a scheme of lessons in the class subject 'Elementary Science.' In fact, for this latter purpose, I have, with some few alterations, used the course for the last nine years.

The principles upon which I have built up my scheme have been those which I have observed to govern the gradual growth of the child mind. First, the child finds itself surrounded by 'things.' Things strange at first, but which gradually pass into the region of things familiar. As the field of observation enlarges, so more and more strange things appear, and one by one pass into the category of things familiar. The faculty of observation is here developed. The strange things are to be correctly observed, and accurately named. This is the work of Standard I. Hence my syllabus here is a course of simple conversational lessons upon the objects around us. The things in the school, the things in the street, the things in the field, and the things in our homes.

The next step in mental growth shows us the child-mind discovery, that among the many objects around us, there are similarities and contrasts. Certain things are *alike* in some respects and unlike in others. This

☞ *Ready This Day. Price 6d. 'Hints on the Art of Reading and Reciting.' With Examples from the writings of Shakspere, Milton, Byron, and Shelley. By Rev. C. Halford Hawkins, M.A., Chaplain and Assistant Master of Winchester College. Contains all P.T.s' Recitation, &c.*

faculty of discrimination can be called into play, only after a knowledge has been imparted of some, at least, of the properties and characteristics of those objects upon which the power of discrimination is being exercised. Hence 'classification' of things is now insisted upon. The work of Standard II. is therefore a continuance of the lessons upon objects, but with the addition of a classification of those objects.

In Standard III. our classification is carried further. As the child's stock of ideas becomes extended, and his knowledge of things deepened, it is found that there are differences as well as similarities among those objects that were previously considered as one class. Hence we must sub-classify. Also in Standard III. as we obtain a greater insight into the nature of things, we must begin to make experiments to show the only true scientific method of arriving at a correct understanding of things. These experiments should be very simple. Such, for instance, as evaporation, condensation, distillation of coal, proof of the presence of air, etc.

The work of Standard IV. will be mainly experimental, and in all the lessons of this stage, there will be a three-fold intention on part of the teacher:—(1) Observation of the results of the experiments. (2) Correct record of these results upon the black board. (3) The deduction of the law which these results indicate. It will be seen here that we have three mental processes brought into play. 'Observation,' or accuracy of perception; 'Judgment' to discriminate facts; and 'Reason' to draw a conclusion from our demonstrated facts. It is quite possible with boys even so young as those of Standard IV., to repeat these processes of scientific investigation so often, that a true habit of enquiry shall be formed and the basis laid for a well-balanced mind. This part of the course will embrace lessons in elementary chemistry, physics, and animal and vegetable life. I have always taken 'Mechanics' as a 'Specific' subject in Standards V. and VI., and have arranged the work of Standard IV. as a preparation for that of the higher standards.

For a course of Object Lessons for Standard V., it would be well to follow the syllabus of the Science and Art Department for that comprehensive subject 'Physiograhpy.' Some slight modification is necessary otherwise the work would be beyond the capabilities of Standard V. children. The same subject furnishes an excellent basis for the work of Standards VI. and VII.

In next week's issue of the 'Practical Teacher,' I will give the full notes of Lessons for Standard I.

The 1891 Scholarship Examination.

BY DR. GEORGE BEACH, M.A.

Co-Author of 'A Manual of our Mother-Tongue,' Author of 'Entertaining Readers.'

UNDER the New Code (*Art.* 41*f*) the final examination of Pupil-Teachers will be the Queen's Scholarship Examination next preceding the termination of their engagements, except that Pupil-Teachers whose engagements terminate between 31st of December and 30th June, or ON either of those dates, may attend the Queen's Scholarship Examination next following the conclusion of their engagements. It is the duty of the managers to see that Pupil-Teachers attending the Queen's Scholarship Examination under the foregoing exception are properly instructed up to the date of examination.

All Pupil-Teachers, therefore, whose apprenticeship expires during the LAST six months of the present natural year have the option either of sitting for 'The Scholarship' on the 8th July, 1891, or of deferring the test until 6th July, 1892.

Those whose term expires during the FIRST six months must attend this year's examination.

The wording of *Art.* 41*f* is ambiguous, owing to the latter date (31st Dec.) being mentioned first.

Examinations are held both at the various Training Colleges (*Art.* 46) and at other centres more convenient for certain candidates.

The SYLLABUS for the examination includes the following subjects:—READING and REPETITION, ENGLISH GRAMMAR and COMPOSITION, ARITHMETIC and MATHEMATICS, GEOGRAPHY, HISTORY and TEACHING. *For particulars, see Schedule V. of the New Code.*

In addition to these, there are four OPTIONAL subjects, viz., MUSIC, DRAWING, LANGUAGE and SCIENCE.

In DRAWING, candidates who have successfully worked *Freehand*, *Geometry*, *Perspective*, or '*Model*' papers will be credited with marks.

Only ONE LANGUAGE may be taken, which may be either *French*, *German*, *Latin* or *Greek*. The ordinary student will find French to be by far the easiest.

Only ONE SCIENCE will carry marks, and it must be selected from *Mechanics*, *Chemistry*, *Animal Physiology*, *Acoustics*, *Light* and *Heat*, *Magnetism* and *Electricity*, *Physiography*, and *Agriculture*. A SECOND CLASS IN THE ELEMENTARY STAGE WILL NOT COUNT. Every Pupil-Teacher should at once arrange to sit for ONE Science and TWO Drawing subjects in May next, unless the marks for these have been previously obtained. Music, too, should not be neglected. The marks for this subject are the most easily earned of all.

Candidates attending the examination must be either Pupil-Teachers entering for their final examination, or, if not Pupil-Teachers, must be over eighteen years of age on 1st January, 1892 (*Art.* 48*a*).

Successful candidates are arranged in three classes in order of merit.

Those IN THE FIRST CLASS may arrange to enter a Training College, or may elect to become Assistant Teachers, or, by the special recommendation of the Inspector, may become 'PROVISIONALLY CERTIFICATED' until they complete their 25th year. Many colleges also admit them at a lower entrance fee. Thus at Winchester the First Class Queen's Scholar pays £5 less than his Second Class brother. The highest on the list also generally monopolise college offices and special privileges.

Those IN THE SECOND CLASS may enter a Training College, or become Assistants, but may not be 'Provisionally Certificated.'

Those IN THE THIRD CLASS may become Assistants, but may neither enter a Training College nor be 'Provisionally Certificated.' In the ordinary sense of the term (although they have just scraped through the Examination) they are not Scholarship holders.

NO ONE WHO FAILS TWICE WILL BE PERMITTED TO TRY AGAIN, but must either leave the profession of a teacher, sink into the unqualified ranks, or pass some qualifying university examination. (*Articles* 48*d* and 50.)

Accordingly all Fourth Year Pupil-Teachers whose engagements end after 29th June, and who feel themselves at all unprepared, should not attempt the examination this year, lest they throw away one half of their opportunities of sitting.

Neither should any but the very best qualified attempt to enter a Metropolitan Training College, but should rather apply to any college whose locality gives them

☞ Messrs. Joseph Hughes & Co. will publish GIRLS' ARITHMETIC (Price 3s. 6d.), by A. C. Dixon, M.A., Senior Wrangler and Fellow of Trinity College, Cambridge, and Dr. Beach, on February 4th, 1891.

claims upon it, and which will probably admit them even should they fail to secure the envied First Class.

It should be particularly noted that no restriction as to the number of times a successful candidate may be examined is imposed.

In fairness to the many Pupil-Teachers who after a long apprenticeship are crowded out of Training Colleges by external candidates, it is to be hoped that the conditions of access to the Scholarship Examination will be shortly made more onerous for outsiders.

THE MONETARY VALUE of a Queen's Scholarship is assessed by the Code at £100 for Males, and £70 for Females.

Some of the most important of the fore-given regulations are quite new, and in conjunction with other provisions will tend greatly to improve the quality of the elementary education given in our schools, and to raise the status of the teaching profession.

Incompetent candidates cannot as heretofore go on attempting to pass 'the Scholarship' year after year, and then at last, having stumbled through, repeat the process with the two certificate examinations.

For, as candidates for certificates must undergo actual TECHNICAL PROFESSIONAL education either in a Training College or by service as assistants in an elementary school, and as neither of these conditions can be satisfied without passing the Scholarship examination or its equivalent, therefore many, who in the past have obtained certificates, would find themselves shut out by the new and improved rules.

Pupil-Teachers in country districts and in the smaller provincial towns are greviously handicapped (1) by moving in an attenuated educational atmosphere, (2) by no foresight having been exercised on their behalf, and (3) by the absence of educational and examinational facilities.

What a multitude of schools still exist where the Pupil Teacher has received no instruction in Drawing and Music! What innumerable districts there are where no Science Classes or Language Classes have been formed!

The ordinary Pupil-Teacher should pass Second Stage Mathematics by the end of his Third Year, and then during his Fourth should attempt two Sciences, so as at least to score Scholarship marks for one.

These remarks are penned in the hope that some Junior Pupil Teachers and Head Masters will profit thereby.

French or Latin should be commenced (where possible) even before the term of apprenticeship, but at any rate during its earlier portion.

Where the Head Teacher does not understand French, and where no classes have been formed, the Pupil Teacher will find it quite possible to come up to the standard of Scholarship French by private study alone, seeing that *no pronunciation is required.*

The very best book for this object is Professor Darqué's Elementary French Course, written purposely for such students.

In our next article, which will appear in the next issue, we shall fully discuss the questions :—

'What Text Books are most suitable for the Scholarship?' 'Which is the best way to use them?' and 'What methods of general study to adopt.'

Concluding, we would urge upon all our readers two points :—

(*a*) To set to work at once, and to continue to labour regularly and industriously.

(*b*) To aim at entering a Training College.

Fourth Year Pupil Teachers, whose limited means forbid immediate entrance, are advised—

(*a*) To pass the Scholarship Examination.

(*b*) To secure an Assistantship, and by frugality accumulate the means to defray the expenses of a Training College—and

(*c*) To study hard during (say) a two years' Assistantship, so as to be sure of a First Class Scholarship on the second attempt. (See Hughes's Training Classes.)

HUGHES'S
Teachers' Training Classes
(By Correspondence).

I. SCHOLARSHIP.

With a view to meet the needs of Pupil-Teachers living in outlying districts, and of others anxious to secure a good position in the

FIRST CLASS,

Mr. Hughes will, forthwith, begin his Scholarship Training Class.

The fee **for the Entire Course** will be the nominal one of

30 *shillings each (payable in advance).*

Pupil-Teachers desirous of having the benefit of this Course must send in their names and addresses (with fee) at once.

Perfect Preparation by Best Staff. Failure Impossible, and a FIRST CLASS assured by all Students who work conscientiously through the Course.

II. CERTIFICATE.

Fee for the Entire Year's Course, £4, Payable £2 upon Entry, and £2 at the expiration of half the course.

☛ *All P.O.O.'s and Postal Orders to be made payable to JOSEPH HUGHES.*

*** Preparations are in progress for Pupil Teachers' Classes (all years), and also for a Teacher's Matriculation Class.

PRIZE Competitions will be held in connection with the above classes.

My Scholarship Answers.

BY MISS ELSIE SCOTT.

(First on the List—Females.)

Domestic Economy.

1. How would you make use of 12 yards of calico, medium quality, in providing underclothing for three children (a boy of four, and two girls of six and eight years of age)? State the amount of material used in each garment.

	yds.	in.
(*a*) *For Boy of* 4 :		
4 shirts (32 × 16)	3	20 in length. 16 in width.
(*b*) *For Girl of* 6 :		
3 chemises (21 × 18)	3	18 in length. 18 in width.
2 pairs of drawers (18 × 25)	2	0 in length. 25 in width.
3 petticoat bodices (12 × 14)	2	0 in length. 14 in width.
(*c*) *For Girl of* 8 :		
3 chemises (25 × 22)	4	6 in length. 22 in width.
2 pairs of drawers (21 × 30)	2	12 in length. 30 in width.
2 petticoat bodices (12½ × 14)		25 in length. 14 in width.
Total length	12	0

The shirts can be cut from the same length as the three smaller chemises. The bodices can be taken from the same length as the three larger chemises. The piece remaining after they have been cut (28 × 14) will make two sets of linings for a child's frock bodice (backs 7 × 7; front 7 × 14). The bands can be taken from the lengths for the drawers. The calico is supposed to be 36 inches wide.

☛ The 'Practical Teacher' will be the recognised organ of Hughes's Teachers' Training Classes.

2. Say what is meant by a 'Benefit Society;' what sort of rules it enforces, and what are the advantages and the risks connected with them.

A benefit society is a society formed to enable depositors, by investing a small sum regularly, to receive help in sickness or want. The rules vary with different societies, but, generally speaking, they require the depositor to be below a certain age, to work at a good trade, and to be of good health and character.

(1) *Advantages.*—(*a*) People are enabled to provide for sickness and old age. (*b*) The payments are not large. (*c*) Good societies, such as the 'Foresters' or 'Oddfellows,' are perfectly reliable.

(2) *Risks.*—(*a*) A new society may not be successful. (*b*) The managers may not be honest, and thus the depositors may lose their savings.

3. What kinds of food are specially useful—(1) For maintaining the heat of the body? (2) For forming flesh? (3) For forming bone? What names are given to these several kinds of food, and why?

(1) *Foods which maintain the warmth of the body.*—These are called *carbonaceous* foods, because they contain a large proportion of carbon. The chief are:—(*a*) *Starch*, found in the grain plants, and also in some other vegetables, *e.g.*, potatoes, arrowroot, &c. (*b*) *Fat*, found in both animal and vegetable foods, *e.g.*, meat, some kinds of fish, milk, and in the vegetable oils, as palm oil, olive oil, &c. (*c*) *Sugar*, found in fruits, some vegetables, and milk.

(2) *Flesh-forming Foods.*—These are called *nitrogenous*, because they all contain nitrogen. The nitrogenous foods are:—(*a*) *Albumen*, found in eggs, meat, and the corn plants. (*b*) *Fibrin*, found in the solid part of the blood. (*c*) *Gelatin*, found in the bones of animals. (*d*) *Gluten*, found in the cereals. (*e*) *Casein*, found in milk. (*f*) *Legumen*, found in the leguminous plants, *e.g.*, peas, beans, lentils, &c.

(3) *Bone-forming Foods.*—These are also called *mineral* foods, because they consist of minerals. The most important bone-making food is *phosphate of lime.*

4. What are the advantages of stewing meat? Give a recipe for an Irish stew, and say how you would choose the pieces of meat most suitable for your purpose.

(*a*) *Advantages of Stewing Meat.*—(1) *Fuel is saved*, for a large fire is not needed. (2) *Labour is lessened*, as it does not require much attention. (3) *Waste is prevented*, for the nourishment which escapes from the meat is eaten in the soup. (4) *The meat is tender* and nourishing.

(*b*) *Recipe for an Irish Stew.*—1½ lbs. of the middle of the neck of mutton; 2 lbs. of potatoes, 4 turnips, and 2 onions. Place the meat and vegetables in the stewpan, with a little pepper and salt. Add sufficient water to cover it, and let it stew gently for about two hours.

(*c*) *How to choose Meat for Stewing.*—The meat chosen for stewing should not contain too many bones, or too much fat. It should be as tender and juicy as possible.

5. What is meant by indigestion? Say why it is harmful, and by what sort of habits it may be either promoted or prevented.

By the term indigestion it is meant that the food we eat, either from not being of a suitable kind, or from some fault in cooking, has not been properly digested or assimilated in the body.

Indigestion is harmful because—(1) The body is not properly nourished. (2) The digestive organs are overworked, and this may probably bring on illness in some future time.

Indigestion is promoted in the following ways:—(1) By eating unsuitable food. (2) By eating food not properly cooked. (3) By taking meals irregularly. (4) By giving an insufficient time for meals.

Conversely, indigestion may be prevented—(1) By eating suitable food. (2) By having food properly cooked. (3) By taking regular meals. (4) By giving sufficient time to them.

6. What is the difference between hard and soft water? For what special purposes is each of them best suited, and why?

Spring and river water is called 'hard' because it contains various mineral substances, such as chalk, and is therefore not so solvent as pure water.

Rain water is called soft because it does not contain these mineral substances, and therefore is more capable of dissolving dirt, &c.

Thus hard water is better for drinking, as the minerals contained in it are useful to the body.

Soft water is better for washing and cleaning, as it absorbs the dirt better.

School Method.

1. Write full Notes of a Lesson on one of these subjects:—(1) The Exploration of Africa. (2) The Analysis of a Sentence. (3) (*For Infants*) A Flower Garden.

HEADS.	MATTER AND METHOD.
The Subject.	Ask the class for the names of some common objects in the room or elsewhere. Write the answers in a column on the blackboard. Then ask the class to say something about each thing, and write the answers by the side. Thus:—
The Predicate.	(Subject): What we speak about. / (Predicate): What we say about it. The fire — burns Birds — fly The clock — ticks The dog — barks The window — is broken
Definition of Subject.	Point out that the first column tells us 'what we we are speaking about.' Write the phrase above. What we speak about is called the 'Subject.' Give the definition, and let the class repeat it. Show by comparison of sentences on board that the subject is a noun or pronoun.
	The second column tells us 'what we say about the subject' (write the phrase above). This is called the Predicate. Give definition, and let the class repeat it. Show that the Predicate always contains a finite verb.
Conclusion.	Having thus shown the essential structure of a simple sentence, write similar examples on the blackboard, which the class can then analyse into Subject and Predicate.

2. Describe the conditions laid down in the Code for the work of the Fourth Standard.

(*a*) *Arithmetic.*—(1) Compound Multiplication. (2) Compound Division. (3) Reduction of Money, Weights and Measures. (4) Problems on the above rules.

(*b*)—*Reading.*—Three Readers, one of which must be Geographical.

(*c*) *Writing.*—A piece of Dictation from the Reader.

(*d*) *Grammar.*—(1) To parse fully any of the parts of speech. (2) To learn 80 lines of poetry from some standard author.

(*e*) *Geography.*—The British Isles, British North America, Australia and New Zealand.

(*f*) *Needlework.*—(1) To put on a flannel patch. (2) To gather and stroke six inches of calico, and set it into a band. (3) To cast on 21 loops and knit the decreasings in the leg of a stocking. (4) To make a band, work a buttonhole, and sew on a button. (5) To mark E. H. I. L. O. T. and to work a darn on a piece of stocking web.

3. Mention any twelve words, the spelling of which presents special difficulties to young learners, and say by what sort of exercises you can best help such learners to spell them correctly.

Words of special difficulty:—

(1) Words with silent letters	*e.g.*	write	know
(2) Words similar in sound	*e.g.*	their	there
(3) Words in which the consonant is doubled	*e.g.*,	run skip	running skipping
(4) Words which drop the final e	*e.g.*	love move	loving moving
(5) Words ending in ugh	*e.g.*	through	though
enough, laugh			
(6) Words in which c is soft	*e.g.*	ceiling	cease

☞ Mr. Ward's (first on list) COMPLETE ANSWERS appear in the January Monthly part of the 'Practical Teacher.' Price 6d. Post free 7½d.

Spelling exercise.—(1) To impress such words on the memories of the children they should be written on the blackboard and the class should look at them carefully, spell them orally, and write them on their slates.

(2) Similar words should be arranged in columns, the resemblances and differences clearly pointed out and other examples given.

(3) The difference in meaning between such words as their and there, grate and great, herd and heard, should be explained, their place in the sentence pointed out, and short sentences containing them given for both transcription and dictation.

(To be continued.)

—o—

Certificate Hints, 1891.

THE new syllabus for certificates in Residential Colleges and for acting teachers has just been issued. The examination will commence on Monday, the 14th of December, 1891.

The first year's course for male candidates is now divided into two parts.

Part I. includes Reading and Repetition from memory, Penmanship, School Management, and Vocal Music. Part II. includes English, Geography, English History, Arithmetic, Algebra and Mensuration, Geometry, and Languages.

Students in Training Colleges who in their first year pass in any British University a preliminary examination approved by the Department, will not be required to present themselves for examination in those portions of Part II. of the syllabus which were included in that University Examination.

The students of the first year and acting teachers taking first year's papers will be expected to read passages from Scott's 'Waverley' and Shakespeare's Henry V. The paper on English will include questions on the language, style and contents of Tennyson's 'Coming and Passing of Arthur' and 25 of Bacon's Essays, viz., the 1, 2, 4, 5, 11, 14—19, 21, 24, 25, 27—32, 36, 38, 39, 50.

Papers will be set in Latin, Greek, French and German, passages being taken from Livy, Book 1; Xenophon's 'Anabasis,' Book 1; Sandeau's 'Mademoiselle de la Seiglière'; Schiller's 'Der Parasit.'

A student may, in his first year, take up two languages or two science subjects; or one language and one science subject, but no more.

The Second Year's Course is also divided into two parts.

Part I. includes Reading and Repetition from Memory, Penmanship, School Management, and Vocal Music.

Part II. The following subjects for the Second Year will be formed into groups: (*a*) School Management; (*b*) English; (*c*) Geography and History; (*d*) Arithmetic, Algebra, Mensuration and Geometry; (*e*) Science; (*f*) Languages; (*g*) Two of the following: One Language, one Science Economy. All candidates must take (*a*) and (*b*), and may take two other groups, but no more.

The Syllabus of Geography is the same for both years. For 1891 the General Geography of the Continent of Africa will be required, and also sketch maps of Africa, Egypt, and of the British possessions in South Africa.

There is no other change.

The Syllabus of History is the same for both years. It is to a great extent recast. We therefore give it in full:—

I. General Outlines of English History from 1066 to 1815:

(*a*) Dates and general knowledge of the most memorable events.

(*b*) Reigning houses and dynastic changes.

II. The History of England during the period of 1789 to 1820, with special reference to:

(*a*) Constitutional changes and most important laws.

(*b*) Military and naval operations abroad and at home.

(*c*) The industrial condition of the people.

(*d*) The literature of the period.

Among the special books prescribed for study are 'King John,' and Tennyson's 'Coming and Passing of Arthur,' and the 25 Essays of Bacon previously mentioned; Livy, Bk. I., and Virgil's 'Æneid,' Bk. I.; Xenophon's 'Anabasis,' Bk. I.; Homer's 'Iliad,' Bk. I.; Sandeau's 'Mademoiselle de la Seiglière; Coppée's 'Le Luthier de Crémone;' Schiller's 'Wilhelm Tell' and 'Der Parasit.'

Students in Training Colleges who in their second year pass in any British University an advanced examination approved by the Department will not be required to present themselves for examination in those portions of Part II. of this Syllabus which were included in that university examination.

A Syllabus for a Third Year's Course is provided:—

Part I. Teaching a class in the presence of H.M.'s Inspector; The Art, Theory, and History of Teaching for 1891; The Life and Work of Arnold; Quick's 'Educational Reformers;' Bain's 'Education as a Science.'

Part II. (1) One of the three following:—(*a*) Languages; (*b*) Mathematics; (*c*) Sciences.

(*a*) Students may select two of the four languages—Latin, Greek, French, German. Easy passages will be given for translation to and from English, with questions on the construction of particular sentences.

(*b*) Students will be examined in Algebra, Euclid I.—IV. and VI., Mensuration, Geometrical Conic Sections, Plane Trigonometry to end of solution of Triangles, and Elementary Statics.

(*c*) Students will be examined in two of the Sciences in the South Kensington Syllabus in the Honours Paper (in which he has not already passed in Honours).

(2) English in 1891: History (Hallam's 'Constitutional History'); Biography (Stanhope's 'Life of Pitt'); Literature ('Paradise Lost,' Bks. I. and II.).

In all other respects the Syllabus is nearly exactly as it was last year.

—o—

Query Column.

General.

1. CLEMENT.—Prove the rule for finding the resultant pressure of a liquid on the surface of a solid wholly or partially immersed in it.

A cube whose edge is a and specific gravity S, floats in a liquid whose specific gravity is $n\,S$; another liquid which does not mix with the former, and whose specific gravity is $S + n$, is poured on to the former liquid; what depth of the second liquid will be just sufficient to cover the cube?

(*Theoretical Mechanics*, 1884.)

Suppose the surface be divided into an indefinite number of small portions s, s', s'', etc., at respective depths, d, d', d'', etc., below the level of the liquid.

Let g be the centre of gravity of the surface of the solid at a depth d° say, p, p', p'', etc., the pressures on s, s', s'', etc., and w the weight of a cubic inch of the liquid.

Then $p = s\,wd$, $p' = s'\,wd'$, $p'' = s''\,wd''$, etc., $\therefore p + p' + p'' = w\,(sd + s'd' + s''d'' + \text{etc.})$

$= wd^\circ \times$ (total area of surface.)

$\therefore$ Whole pressure on the surface $= wd^\circ$ (area of surface). That is, the pressure on the surface is the weight of a column of liquid, whose base is the area pressed, and altitude the depth of the centre of gravity.

Let x = the depth of the second liquid required, then $(a - x)$ = depth immersed in bottom liquid.

Now, weight of cube = weight of displaced liquid,
weight of cube = (vol. × sp. gr.) = $a^3 S$;
weight of top liquid displaced = (vol. × sp. gr.) = $a^3 \times \frac{S}{n}$
Weight of bottom liquid displaced = $(a - x)\, a^2 \times nS$.

$$\therefore a^3 S = a^2 x \times \frac{S}{n} + (a - x)\, a^2 \times nS.$$

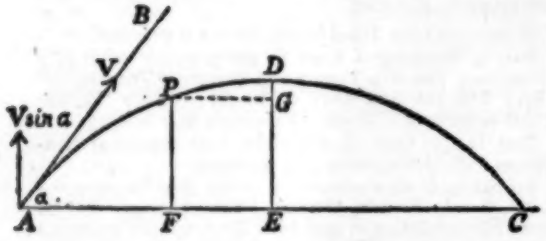
$$\therefore a = \frac{x}{n} + n(a - x)$$

$$na = x + n^2 a - n^2 x$$

$$\therefore x = \frac{n^2 a - na}{n^2 - 1} = \frac{na(n-1)}{n^2 - 1} = \frac{na}{n+1}.$$

2. WOOLWICH.—Find the time of flight and *greatest* height of a projectile with reference to the horizontal plane passing through the point of projection.

If t be the time in which the projectile reaches a point P, and t' the time from P until it strikes the horizontal plane through the point of projection, prove that the height of P above that plane is $\frac{1}{2} g t t'$. Hence verify the expression for the greatest height. (*Woolwich Exam.*)



Let V be the velocity of projection, and α the angle of elevation of the projectile. The path is shown in the figure, AC being the *range* on the horizontal plane and D the highest point. As the only force tending to draw the projectile from its original straight line path is the force of gravity, the vertical displacement throughout the motion will be subject to the laws of falling bodies.

To find the greatest height:

Vertical component of velocity of projectile = V sin α v, say.

If v be the vertical component of the velocity at any point we have, since the motion, as far as D, is opposed to gravity

$$v^2 = v_1^2 - 2gh \quad (1)$$

where h = vertical displacement from A and v_1 the initial vertical velocity.

At the highest point D $v = 0$, and $v_1 = V \sin \alpha$,

$\therefore$ from (1) $V^2 \sin^2 \alpha = 2gh$

$$\therefore h = \frac{V^2 \sin^2 \alpha}{2g} = \text{greatest height.}$$

To find time of flight:

Let t_0 be the time of flight to D, the highest point.

Then, vertical velocity at D $= v_1 - g t_0 = 0$;

$$\therefore t_0 = \frac{v_1}{g} = \frac{V \sin \alpha}{g}.$$

$$\therefore \text{whole time of flight} = \frac{2 V \sin \alpha}{g}.$$

Now $t_0^2 = \frac{V^2 \sin^2 \alpha}{g^2} = \frac{V^2 \sin^2 \alpha}{2g} \cdot \frac{2}{g} = \frac{2}{g} \cdot h$;

$\therefore h = \frac{1}{2} g t_0^2$ (2).

Take one point P, and let its vertical height from the horizontal plane = h'.

Since t is the time of flight from A to P, and t_0 from A to D, the time taken in passing from P to D = $t_0 - t$. This is the time which it would take if the projectile fell freely from D through a vertical distance = DE − PF, *i.e.*, = $h - h'$.

$$\therefore h - h' = \tfrac{1}{2} g (t_0 - t)^2$$

Substituting for h from (2) we get

$$\tfrac{1}{2} g t_0^2 - h' = \tfrac{1}{2} g t_0^2 - g t t_0 + \tfrac{1}{2} g t^2$$

$$\therefore - h' = \tfrac{1}{2} g t^2 - g t t_0.$$

But $t_0 = \frac{t + t'}{2}$ and substituting this value gives

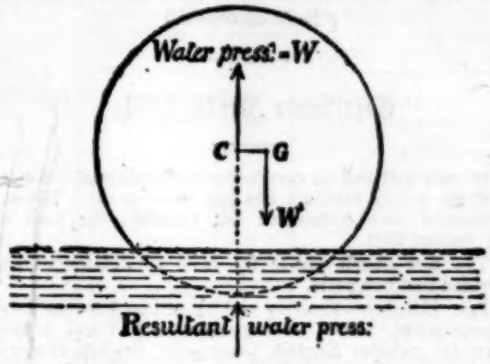
$$- h' = \tfrac{1}{2} g t^2 - \tfrac{1}{2} g t^2 - \tfrac{1}{2} g t t';$$

$$\therefore h' = \tfrac{1}{2} g t t'. \qquad \text{Q.E.D.}$$

3. S. E. P.—A sphere lighter than an equal volume of water has its centre of gravity not coincident with its geometrical centre. State in what position it will float if put in water, and explain why it takes that position. A common wine cork is nearly two inches long; cut from it a slice (like a wafer) about a quarter of an inch thick; if placed in water, the cork and the slice are observed to float in different positions; explain the observed difference.

(*Science and Art Theoretical Mechanics.*)

The sphere will float in such a position that the centre of gravity will be vertically beneath the geometrical centre.



Let the figure represent the sphere in a certain position, G being the centre of gravity and C the geometrical centre.

The resultant vertical pressure of the water will obviously always pass through C, no matter what position the sphere takes up.

In the position shown we have the weight of the sphere acting vertically downwards through G, and the pressure of the water acting vertically upwards through C. These two forces must be equal (or the vessel would either rise or sink), and consequently they form a couple tending to turn the sphere round until the arm of the couple is destroyed; *i.e.*, until G comes vertically beneath C. However slightly G be on either side of C the couple will exist, and will turn the sphere into such a position that its centre of gravity *is as low as possible*. The sphere would also be in equilibrium if G was vertically above C, but it would be unstable, and the slightest touch would cause it to completely heel over into the stated position.

In the case of the wine cork, the cork itself would float with its ends at right angles to the surface of the water, whereas the wafer-like piece would float with its circular faces parallel to the surface of the water. These two positions are those of stable equilibrium in the respective cases, and the positions in which the respective centres of gravity are at their lowest points.

Algebra.

1. ANNIE LINDSAY.—A man leaves his property to be divided among his children as follows: the eldest to have £1,000 and $\frac{1}{10}$ of the sum remaining: the next £2,000 and $\frac{1}{10}$ of the sum then remaining; the next £3,000 and $\frac{1}{10}$ of the sum then remaining, and so on. If all have the same legacy, find the whole property and the number of children.

Let x = value of property in pounds.

Then $1000 + \frac{1}{10}(x - 1000)$

$$= 2000 + \tfrac{1}{10}\left(x - 1000 - \frac{x - 1000}{10} - 2000\right)$$

$$1000 + \frac{x}{10} - 100 = 2000 + \frac{x}{10} - 100 - \frac{x}{100} + 10 - 200$$

$$900 = 1710 - \frac{x}{100}$$

$$\frac{x}{100} = 1710 - 900$$

$$= 810$$

$$\therefore x = 81000.$$

$\therefore$ Value of whole property = £81,000. Ans.

Amount received by each child
= £1,000 + $\frac{1}{10}$ (£81,000 − £1,000)
= £9,000;

$\therefore$ Number of children = £81,000 ÷ £9,000
= 9. Ans.

STANDARD III.

Arithmetic.—Work the following sums :—

1. Add £458 19s. 8d.; £73 18s. 6d.; £589 17s. 4d.; £6357 18s. 9d.; £783 14s. 4d.; £196 18s. 3d. & £5486 13s. 7d. Ans. £13,948 0s. 5d.

2. Take £378 19s. 9d. from £4,129 18s. 4d. Ans. £3,750 18s. 7d.

3. Divide 86,943 by 94. Ans. 924 + 87

4. In a forest there were 6,080 oak, ash and elm trees. There were 194 ash and 1,924 elm trees. How many oak trees were there? Ans. 3,962 oak trees.

Mental Arithmetic.—

1. How many half-crowns are there in £1? Ans. 8.
2. What are three half-crowns worth? Ans. 7s. 6d.
3. What are five half-crowns worth? Ans. 12s. 6d.
4. What is the difference? Ans. 5s.
5. Divide 5 shillings among 4 boys. Ans. 1s, 3d. each.
6. Explain how you did this?
7. What rule did you employ? Ans. Division.
8. If 1 lb. of butter cost 1s. 4d., what does ½ lb. cost? Ans. 8d.
9. How many ounces in half a pound? Ans. 8 oz.
10. How much is that for one ounce? Ans. 1d.
11. Add 9, 6, 5, and 4. Ans. 24.
12. What number taken from 100 leaves 54? Ans. 46.

Dictation.—Boys and Girls :—

In order to reach the camp, he and his men had to march through a thick forest. It was the spring time of the year, so the woods would be alive with the singing of birds, and the air would be filled with the smell of spring flowers. This would be a pleasant change for Alfred and his followers after their weary months of hiding.

Geography :—

1. What river flows by London?
2. Where does it empty its water?
3. What counties are washed by the North Sea?
4. Name a great northern port on this sea.
5. What goods are brought to this port?
6. Why is this?
7. Where is wool manufactured?
8. Name the chief town on the east coast engaged in the North Sea Fishery.
9. What are the principal fish caught.
10. What river joins the Trent to form the Humber?
11. Where is iron smelted?
12. Why in this neighbourhood?
13. What railway runs to York?
14. Where is its terminus in London?
15. What seaports are in Hampshire?
16. Where is Birmingham?
17. What is made there?
18. Why is it called the toy-shop of the world?
19. Where are hops grown?
20. Which is the 'Fen' district?

Grammar.—'On foot I gaily take my way.'

1. What part of speech is foot?
2. Point out the pronouns.
3. What part of speech is gaily?
4. What word does it tell you about?
5. What kind of noun is way?
6. Name any other kinds of nouns you know.
7. Name an adverb that tells time.
8. Form a sentence using that adverb.
9. What is a pronoun?
10. What is the difference between I and we?
11. Name an adverb that can be an adjective.
12. Form sentences illustrating each.

STANDARD IV.

Arithmetic.—Girls only :—

1. Multiply £17085 12s. 0½d. by 95. Ans. £1623132 5s. 11½d.
2. Divide £65453 5s. 7½d. by 49. Ans. £1335 15s. 7½d.
3. How many ounces of tea can be weighed out of a chest containing 3 qrs. 16 lbs.? Ans. 1,600 ounces.
4. If eggs are bought at 20 a shilling and sold at a shilling a dozen, what would be gained by buying and selling 360 dozen eggs? Ans. £7 4s. 0d.

Arithmetic.—Boys only :—

1. Divide £372,000 7s. 9d. by 374. Ans. £994 13s. 0¾d. + 114.
2. Multiply £508 2s. 10¾d. by 315. Ans. £160,065 12s. 2¼d.
3. Find the number of stones in 418 tons 16 cwts. 84 lbs. Ans. 67,014 stones.
4. How many times does a wheel which is 16½ feet round, turn in going 65 miles? Ans. 21,120 times.

Dictation.—Boys and Girls :—

The night crept on apace, the moon went down, the stars grew pale and dim, and morning cold and grey slowly approached. Then from behind a distant hill, the noble sun rose up, driving the mists in phantom shapes before it, and clearing the earth of their ghostly forms till darkness came again. When it had climbed higher into the sky and there was warmth in its cheerful beams, they laid them down to sleep, upon a bank, hard by some water.

NOTE.—All the Dictation tests are taken from books not in use in elementary schools. They therefore will make a valuable collection of previously unseen specimens in Dictation.

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418,732	12	7	908,907	14	10
98,976	15	9	656,432	13	4
567,209	19	10	65,416	15	9
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176,594	14	6	46,597	12	7
495,671	18	11	232,917	15	6
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649,538	19	10	159,634	17	10
74,912	14	8	72,496	15	9
544,397	15	7	416,492	14	7
786,546	12	11	177,896	12	8
59,778	13	6	505,491	13	6
432,109	17	9	90,876	19	5
88,979	16	5	483,295	15	9
636,475	15	8	598,437	17	8
495,123	18	9	694,591	18	7
137,909	17	7	59,438	19	4

N.B.—In our next number will be found the remaining questions for Standard IV., and complete sets of questions in Standards V., VI. and VII.

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